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# Mapping Sustainable Finance Research: A Bibliometric Perspective

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***Abstract:*** ***This study describes a comprehensive bibliometric analysis of scholarly publications and practices in sustainable finance research, aiming to identify the global research patterns in this field. Sourcing data from several reputable academic journals from 2014 to 2024 identified key research clusters, prolific authors, and institutions. The purpose of this study is to investigate trends and literature development in sustainable finance, which is an emerging research issue. Bibliometric analysis of sustainable finance trends and literature development using the Web of Science database. Use the keyword "sustainable finance" to retrieve the results. There are 833 document results in the Web of Science database. After applying the inclusion and exclusion criteria, which limited the results to 2014-24 and refined the results by areas such as Business Economics, Environmental Sciences, Ecology, and Social Sciences Other Topics, the final number of document results is 598. Biblioshiny and VOS Viewer are the tools to use for bibliometric analysis.***
***Keywords: Sustainable Finance, Sustainable Development, Sustainable Investment, Bibliometrics, Biblioshiny***

## I. INTRODUCTION

Sustainable finance is key to fostering sustainable global development. Research in this field has focused on specific topics, such as the financial performance of sustainable investments and companies committed to sustainability (Cunha et al., 2021). Sustainable finance and green finance are sometimes used interchangeably in various reports and studies. However, the term sustainable finance is more comprehensive than green finance, as it represents a progression or advancement from green finance (Yadav et al., 2023). Sustainable finance has emerged as a critical area of study in response to growing environmental, social, and governance (ESG) concerns worldwide. In recent years, there has been a notable increase in scholarly interest in understanding how financial markets, institutions, and systems can contribute to sustainable development. Sustainable finance involves incorporating environmental, social, and governance (ESG) factors into financial decision-making processes. The approach encompasses several tactics and monetary tools, such as green bonds, screening, impact investment, socially responsible investing, and others. Sustainable finance integrates environmental, social, and governance considerations in financial decision-making, evolving from ethical investing to a central part of risk management strategies and promoting long-term strategic growth. Sustainable finance is a burgeoning financial concept that is gaining traction and undergoing active discussion and development. There are varying perspectives on the definition of the term "Sustainable" in the realm of finance. Therefore, there is currently no universal agreement on the precise meaning of sustainable. The term "Sustainable" originates from the Latin language (Purnomo et al., 2021).

Sustainable finance is an evolving paradigm that integrates environmental, social, and governance (ESG) criteria into financial decision-making processes, aiming to ensure that financial activities support sustainable development goals. The incorporation of ESG factors helps investors assess the long-term viability and ethical impact of their investments, moving beyond traditional financial metrics to encompass broader societal impacts (Friede, Busch, & Bassen, 2015). ESG criteria are increasingly recognized as essential components of risk assessment and value creation, as they help identify material risks and opportunities associated with climate change, resource scarcity, social inequities, and governance failures (Clark, Feiner, & Viehs, 2015). Sustainable finance aligns financial practices with ethical and ecological considerations, promoting responsible investment and corporate behavior. This integration of ESG into financial analysis is not only a moral imperative but is also seen as a strategic advantage, as empirical evidence suggests that ESG-compliant companies often demonstrate superior financial performance and resilience in the face of economic challenges (Giese, Lee, Melas, Nagy, & Nishikawa, 2019).

Digitalization of financial services, reducing the need for physical branches and thereby minimizing the carbon footprint. Highlight trends in sustainable finance research that emphasize the importance of energy-efficient technology in financial services.

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Sustainable ATM management practices, such as the use of recycled materials, reducing paper usage (e.g., through electronic receipts), and minimizing energy consumption. This can be linked to research trends in corporate sustainability and environmental responsibility in the financial sector. ATMs could serve as a channel for promoting green finance products, such as loans for renewable energy projects or investment in sustainable funds.

Bibliometric analysis serves as a powerful tool for systematically quantifying and analyzing the impact and dissemination of scholarly work. By utilizing bibliometric indicators such as citation counts, co-authorship networks, and keyword co-occurrence, researchers can uncover underlying trends, pinpoint knowledge gaps, and spotlight influential research contributions (Zupic & Čater, 2015). This method enhances understanding of the current research landscape and informs the direction of future scholarly endeavors. In the social sciences, bibliometric studies have highlighted a wide range of research topics, including sociology, psychology, political science, and economics (Small, 1999). These studies emphasize the significance of interdisciplinary collaboration and the evolving nature of academic inquiry in tackling complex societal challenges. By mapping existing literature, scholars can identify the most impactful works and emerging areas of interest, guiding future research and policy efforts (Chen et al., 2021). This paper seeks to add to the existing bibliometric literature by providing a comprehensive analysis of academic publications and practices within the social sciences. Through the use of advanced bibliometric techniques, we aim to clarify both the structural and thematic aspects of the research landscape, offering valuable insights into the development and dissemination of knowledge in this dynamic field. Our analysis aspires to enhance understanding of the intellectual framework of social sciences, spotlight significant research contributions, and identify potential avenues for future exploration.

### *A. Objective of this Study*

The objective of this study, is to explore the different dimensions of sustainable finance, in the existing literature, systematically analyse the existing literature using bibliometric methods in order to map the global research patterns.

To fulfil the objective of this research,

RQ1 What is the literature development status of sustainable finance?

RQ2 What is different themes and sub themes in area of sustainable finance?

RQ3 How much of the sustainable finance literature is diverse?

## II. RESEARCH PROBLEM

Research problem is particularly pertinent given the complexity and interdisciplinary nature of sustainable finance, which spans domains such as economics, environmental science, and policy studies (Giese, Lee, Melas, Nagy, & Nishikawa, 2019). Current gaps in knowledge impede researchers and practitioners from fully grasping the progression and integration of sustainability within financial studies, thus potentially limiting the effectiveness of sustainability-driven financial strategies and innovations. Bibliometric perspective, this study aims to address these gaps by quantitatively analyzing the body of literature on sustainable finance. This will enable the identification of emerging trends, influential publications, and collaborative networks, providing a comprehensive overview that can guide future research and policy initiatives (Zupic & Čater, 2015). Bibliometric studies centers on the challenge of systematically mapping and understanding the vast and ever-evolving landscape of academic literature across various fields. As the volume of scholarly publications continues to grow exponentially, it becomes increasingly difficult for researchers to identify key trends, influential works, and emerging areas of interest without a structured analytical approach. Bibliometric studies address this challenge by utilizing quantitative methods to analyze patterns in citations, authorship, and thematic content. Despite their utility, bibliometric analyses can face limitations such as the quality and coverage of data sources, the choice of indicators to accurately capture research impact, and the interpretation of results across disciplinary boundaries. Addressing these challenges is essential to leveraging bibliometrics effectively, thereby facilitating a deeper understanding of research dynamics and guiding future scholarly and policy directions.

## III. METHODOLOGY

Bibliometric methodology traces the evolution of research progress in the area of sustainable finance. Bibliometrics is a quantitative approach that enables the systematic analysis of existing literature, allowing researchers to uncover development patterns and discern conclusive research trends (Weber, O., & Feltmate., 2018). Bibliometric analysis is an important tool for identifying and mapping the corpus of literature within specific research domains. Through the application of bibliometric techniques, researchers can uncover patterns of intellectual development, including publication trends, citation dynamics, influential authors, and highly cited works (Pritchard, A. ,1969).

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Through the adoption of a bibliometric approach, this study contributes to the growing body of literature that employs quantitative methods to map the evolution of research fields. By offering a systematic and data-driven perspective on the development of sustainable finance research.

## IV. PRISMA FRAMEWORK

Data Extraction
Keyword: "sustainable finance" – All fields
Data Base: Web of Science
Total Results: 833

### *A. Result Analysis*

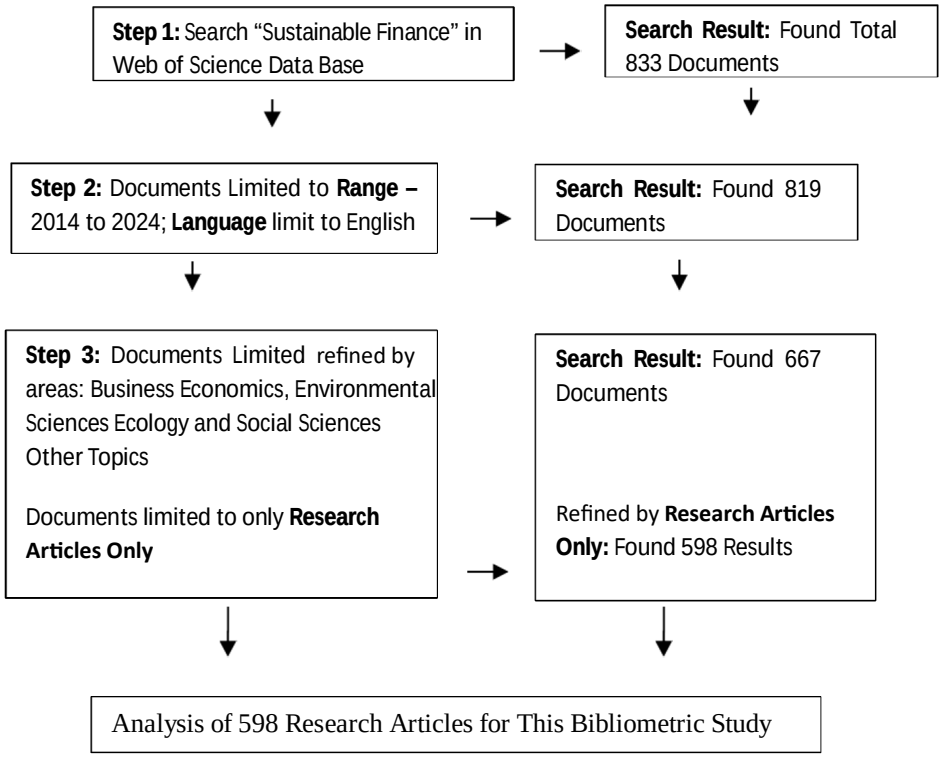



Figure 1 Process of Short-listing process of documents

In this study, bibliometric data extracted from Web of Science database. The PRISMA process allowed for the screening and final selection of 598 papers for the bibliometric analysis presented in (Fig.1). The methodology used for this bibliometric and scientometric analysis involves the use of two specific tools: the Biblioshiny application of the bibliometrix 4.1.2 package in R (Aria & Cuccurullo, 2017) for performance analysis, and VOSviewer 1.6.17 for network visualization (Van Eck & Waltman, 2010). These methodologies were extensively utilized in several previous review studies across different contexts, such as those conducted by Au-Yong-Oliveira et al. (2021), de Bruyn et al. (2023), and Soliman et al. (2021).

Biblioshiny, a software tool, was utilized to assess and analyze the performance indicators of the scholarly environment. The process involved evaluating multiple indicators, such as the number of publications, frequency of citations, and patterns of collaboration, in order to acquire a deeper understanding of the impact and influence of the analyzed documents. An example of this is a thematic map, which is typically created using the Bibliometrix software, and it offers a visual depiction of the thematic organization within a set of academic papers. Moreover, it presents groups of associated subjects, emphasizing the main ideas and their relationships. The R programming language facilitated the network visualization element. This tool enabled the generation of visual depictions that capture the complex connections and partnerships among various institutions within the academic field. The utilization of network visualization allowed for the detection of clusters, patterns, and crucial links, thereby providing a thorough comprehension of the structure and dynamics of the intellectual landscape.

The methodology combined the capabilities of Biblioshiny for performance analysis and the R programming language for network visualization, resulting in a comprehensive investigation of scholarly efforts. In this study project, the independent variables consisted of the combined number of publications (NP), the total number of citations, the number of authors associated with the research, and the productivity of writers based on their country (Hendrix, 2008). The dependent variables consisted of various determined metrics, including the h-index for sources and authors, as well as the centrality and density indices computed for the thematic map.

## V. RESULTS AND DISCUSSION

### *A. Performance Analysis*

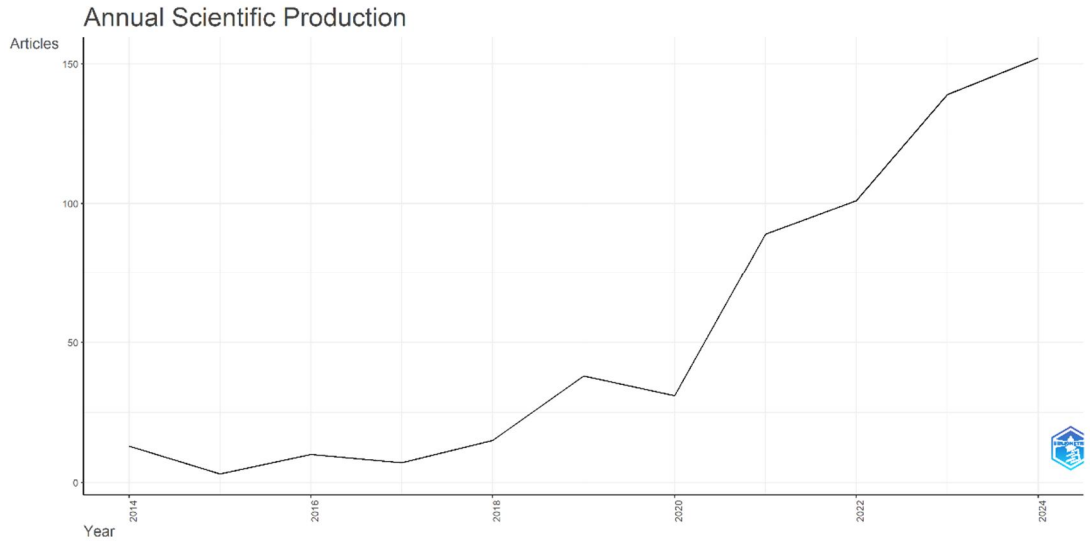
The first analysis reveals a summary of the performance of the selected publications, as presented Table 1.

| Description | Results |
|---|---|
| MAIN INFORMATION ABOUT DATA | |
| Timespan | 2014:2024 |
| Sources (Journals, Books, etc) | 181 |
| Documents | 598 |
| Annual Growth Rate % | 27.88 |
| Document Average Age | 2.17 |
| Average citations per doc | 19.59 |
| References | 31755 |
| DOCUMENT CONTENTS | |
| Keywords Plus (ID) | 1191 |
| Author's Keywords (DE) | 1961 |
| AUTHORS | |
| Authors | 1538 |
| Authors of single-authored docs | 77 |
| AUTHORS COLLABORATION | |
| Single-authored docs | 86 |
| Co-Authors per Doc | 3.17 |
| International co-authorships % | 46.32 |
| DOCUMENT TYPES | |
| article | 543 |
| article; early access | 41 |
| article; proceedings paper | 14 |

(Table 1) describes documents published from 2014 to 2024 across 181 different sources, indicating a diverse and potentially interdisciplinary scope. The annual growth rate of scholarly documents stands at a substantial 27.88%, suggesting an accelerating interest and expansion in the field. Average age of documents is relatively young at 2.17 years, which implies that the field is rapidly evolving with frequent updates and new findings. This trend is further supported by the relatively high average of 19.59 citations per document, reflecting the impactful and influential nature of research being conducted. With a total of 31,755 references cited within these documents, researchers are building upon a robust foundation of prior work, contributing to a continuous cycle of knowledge enhancement. Diversity in keywords, both those provided by authors (1961 unique terms) and those indexed through Keywords Plus (1191 terms). This variety signifies the breadth of topics covered and the dynamic nature of research themes in the field. Authorship, 1,538 unique authors, among which 77 have produced single-authored works, highlighting the presence of individual expertise alongside collaborative efforts. The emphasis on collaboration is evident with an average of 3.17 co-authors per document and an international co-authorship rate of 46.32%. Such high levels of collaboration, particularly across borders, may contribute to the richness and diversity of perspectives, fostering innovations and solutions that benefit from global insights. Document types, the majority are articles (543), with a smaller number designated as either "article; early access" (41) or "article; proceedings paper" (14). This distribution suggests that while traditional journal articles remain the primary mode of scientific communication, there is also a significant amount of interest in disseminating research quickly through early access, as well as through conference proceedings, allowing for the timely exchange of ideas and findings in fast-moving research areas.

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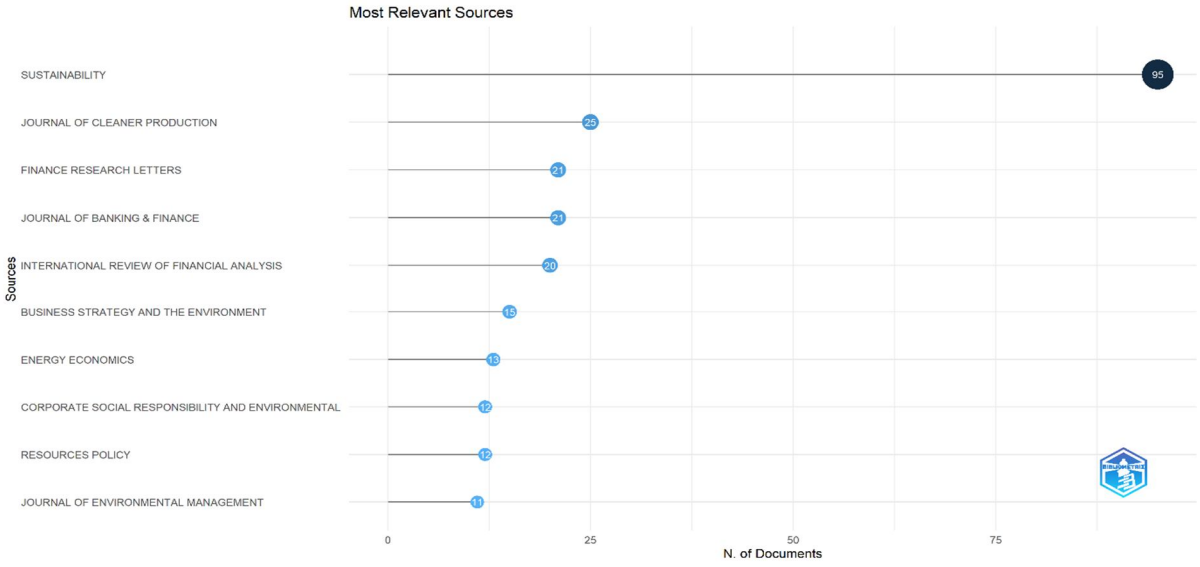
*B. Annual Scientific Production*




(Figure 2)
*Source: with help of Biblioshiny Complied by Authors*

Significant upward trend in annual scientific production from 2014 to 2024. Starting with minimal activity, there is a marked increase around 2016, followed by fluctuations, and a dramatic rise starting in 2021. This trend reflects growing interest and investment in the field, leading to a substantial increase in research output over the past few years.

*C. Most Relevant Sources*



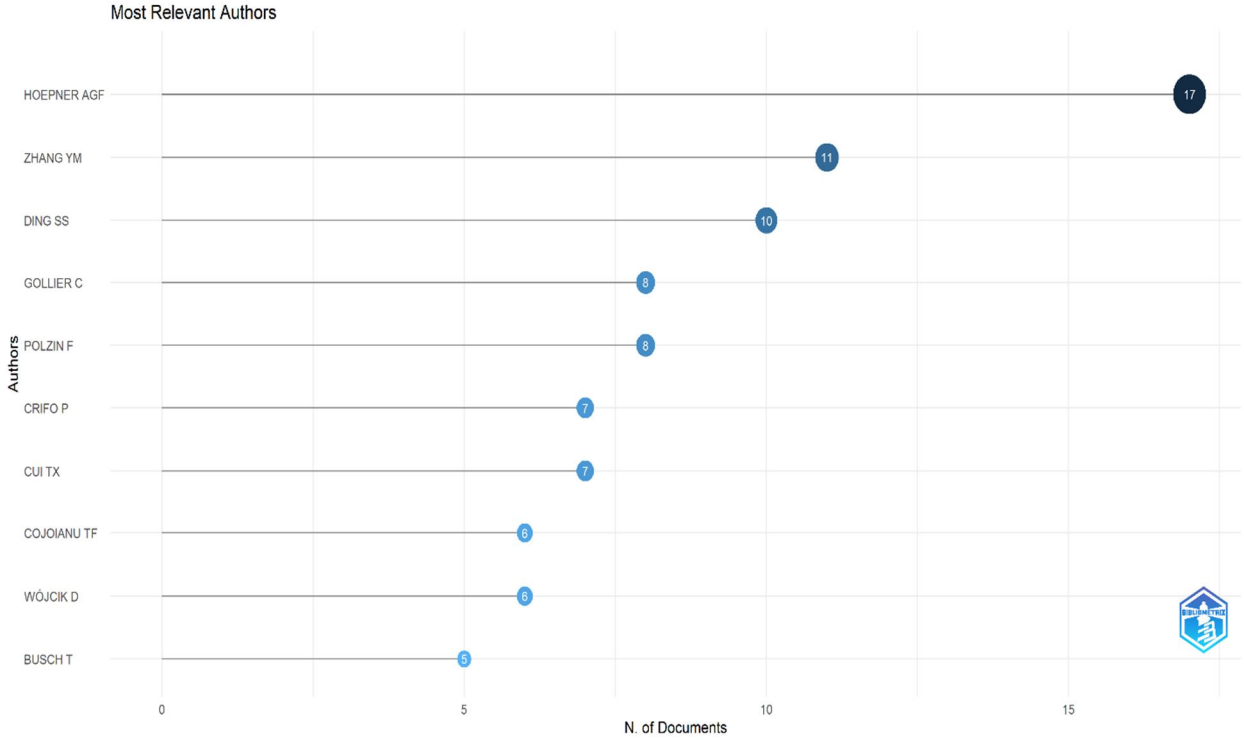

(Figure 3)
*Source: with help of Biblioshiny Complied by Authors*

(Figure 3) shows that an increase in scientific output from 2014 to 2024, with a particularly notable surge in recent years, indicating heightened activity and interest in the field. The journal "Sustainability" leads as the most prolific source with 56 documents, highlighting its central role in publishing related research. Other journals, such as the "Journal of Cleaner Production" and "Finance Research Letters," also contribute significantly, reflecting the interdisciplinary nature of the research, which spans environmental, financial, and corporate responsibility topics. This diversity of sources underscores the broad relevance and application of the field's research across various domains.

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*D. Most Relevant Authors*




(Figure 4)
*Source: with help of Biblioshiny Complied by Authors*

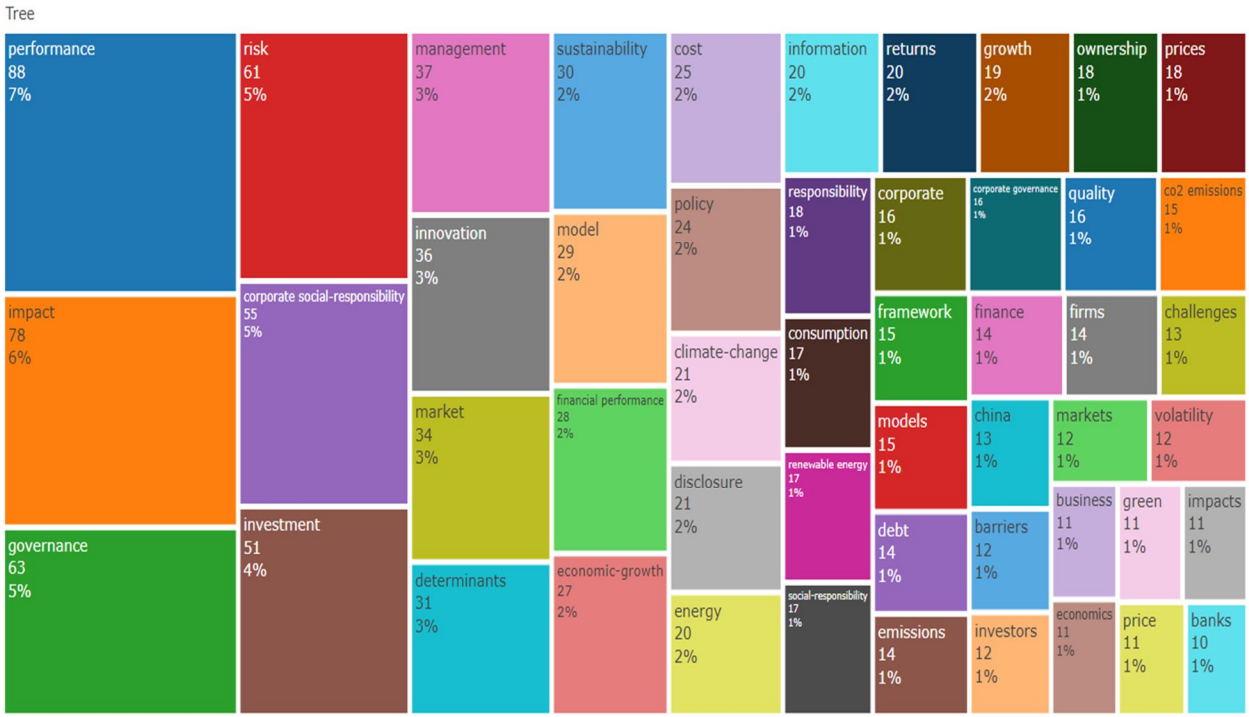
Most influential authors in the field, with Hopner AGF leading significantly with 17 publications. This prolific output indicates a strong influence and active engagement in research. Following are Zhang YW and Ding SG, with 11 and 10 documents respectively, showcasing their substantial contributions. Other notable authors include Gollier C, Polzin F, and Crifo P, each contributing 8 to 10 publications. This group of researchers plays a pivotal role in advancing the field, driving innovation and thought leadership. Their collaborative efforts and consistent output underscore the dynamic and evolving nature of research in this area.

*E. Word Cloud*




(Figure 5)
*Source: with help of Biblioshiny Complied by Authors*

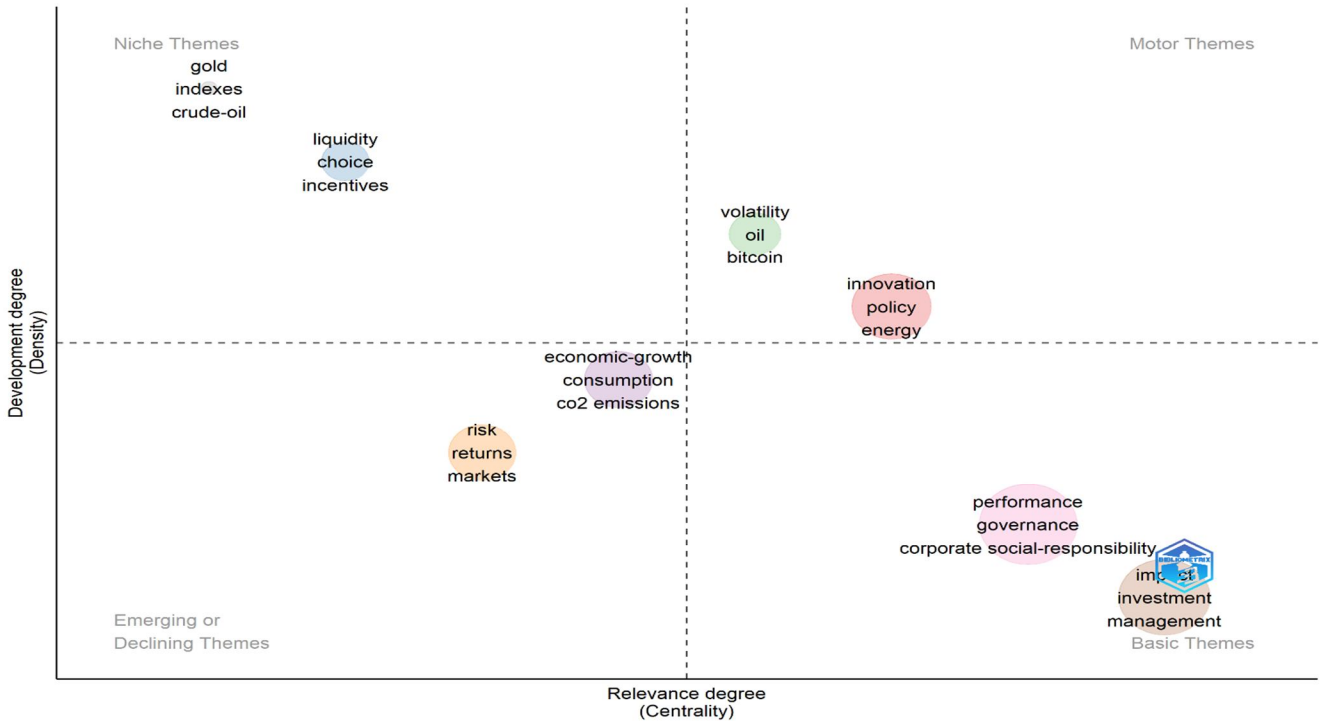
*F. Tree Map*




(Figure 6)

*Source: with help of Biblioshiny Complied by Authors*

*G. Thematic Map*

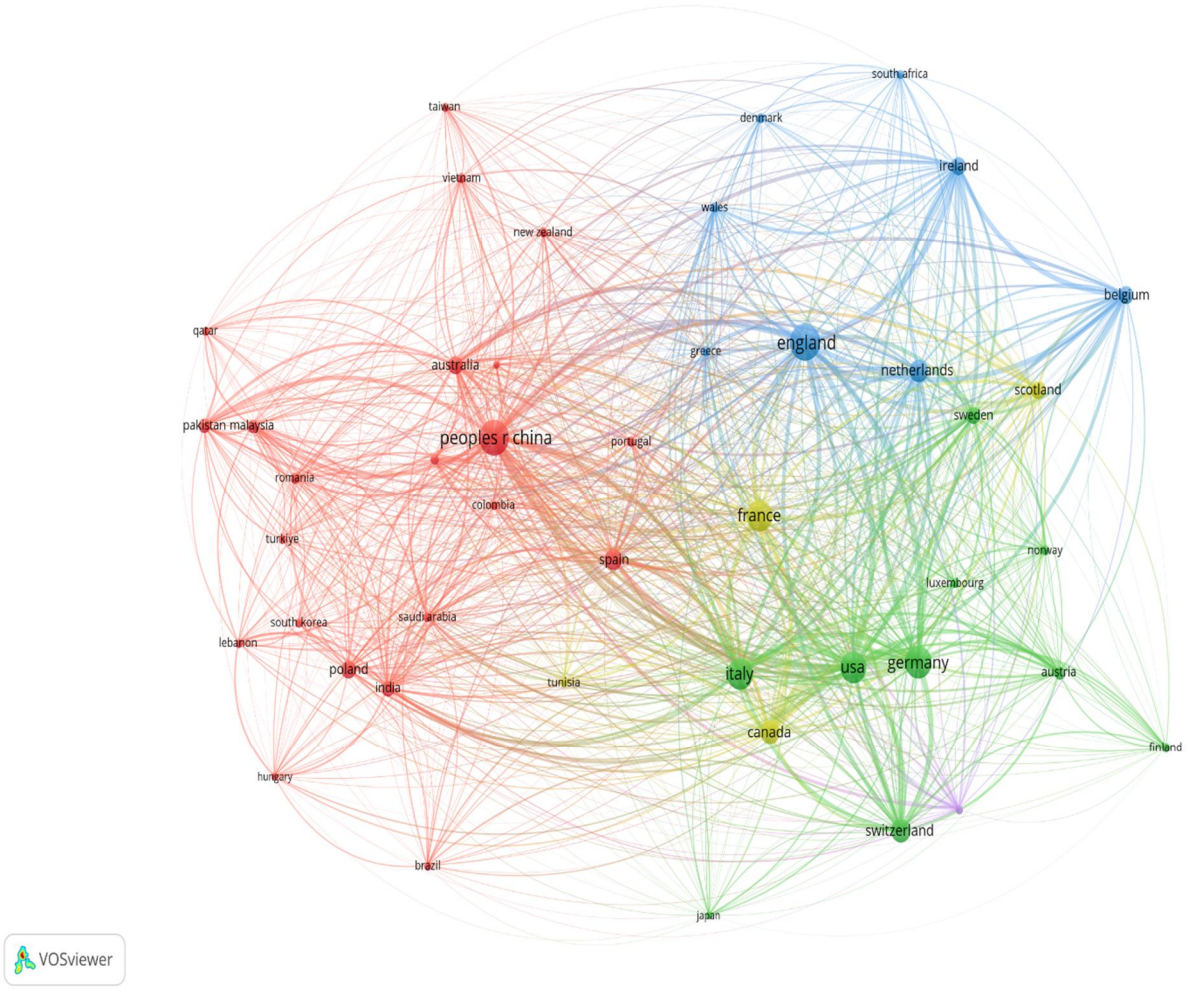



(Figure 7)

*Source: with help of Biblioshiny Complied by Authors*

Thematic map highlights the multifaceted nature of the research landscape, with a mix of specialized niche topics, core driving themes, emerging areas, and fundamental concepts. This diversity suggests a dynamic and evolving field that encompasses various perspectives and approaches to address relevant issues and challenges.

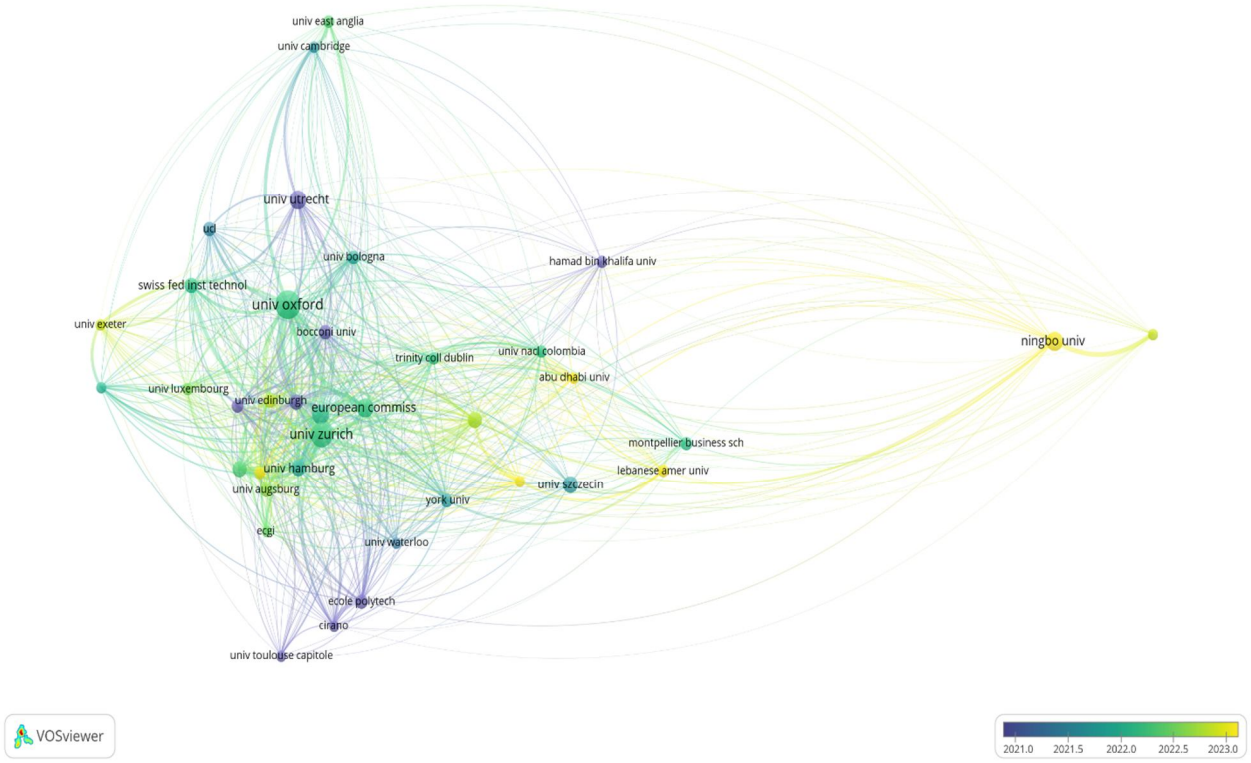
*H. Network Visualisation Bibliographic Coupling Countries*




(Figure 8)
*Source: with help of VOSviewer Complied by Authors*

The network visualization you provided represents bibliographic coupling between countries, with nodes representing countries and links representing the strength of their bibliographic connections. The countries are grouped into clusters based on the intensity of their scholarly collaboration. Red Cluster dominated by China, this cluster includes several Asian countries like Taiwan, Vietnam, and Australia. These nations show strong bibliographic connections, indicating extensive collaboration or citation patterns within this group. Blue Cluster , England is central in this cluster, which includes Belgium, Ireland, and other European countries. The connections suggest a robust academic collaboration network, primarily within Europe, reflecting shared research interests and high citation rates. Green Cluster, USA and Germany are prominent in this cluster, reflecting strong scholarly connections with countries like Italy, Canada, and Switzerland. This cluster indicates significant transatlantic collaboration and shared research across various disciplines. Yellow Cluster, France leads this group, with connections to Spain, Portugal, and other European nations. The clustering here highlights regional cooperation in research activities, particularly within Southern Europe.

*I. Network Visualisation Bibliographic Coupling by Organisation*




(Figure 9)
*Source: with help of VOSviewer Complied by Authors*

The network visualization shows bibliographic coupling among various academic institutions and organizations, with nodes representing institutions and links indicating the strength of their bibliographic connections. Central Nodes, Institutions like University of Oxford, University of Zurich, and University of Utrecht are central, indicating that they are highly interconnected and have strong bibliographic coupling with other organizations. This suggests these institutions are key players in collaborative research. Peripheral Nodes, Ningbo University is more isolated on the right side, with connections primarily in 2022 and 2023, indicating its more recent emergence in collaborative research networks. Clusters The visualization displays several clusters, with European institutions (e.g., Swiss Federal Institute of Technology, University of Cambridge) prominently connected, reflecting strong regional academic collaboration, particularly within Europe.

## VI. CONCLUSIONS

Societal concerns about sustainability and sustainable development have highlighted challenges in sustainable finance (Ferreira, C. R. de; C., Sobreiro; V. A., Kimura; H., & Barboza; F. L. de M., 2016) Over the past few decades, the increasing number of publications in sustainable finance reflects its emergence as a significant research area. Bibliometric analysis and discussions on the sustainability of finance reveal numerous research opportunities for regulatory bodies and scholars. Despite the growing interest, there remains a substantial research gap in sustainable finance, presenting opportunities for further exploration at the intersection of sustainability and finance. This bibliometric analysis reveals that sustainable finance literature is not confined to finance alone; it integrates various interdisciplinary fields, including environmental engineering, sustainable development, and economic growth. However, research focused solely on sustainable finance has made limited intellectual contributions.

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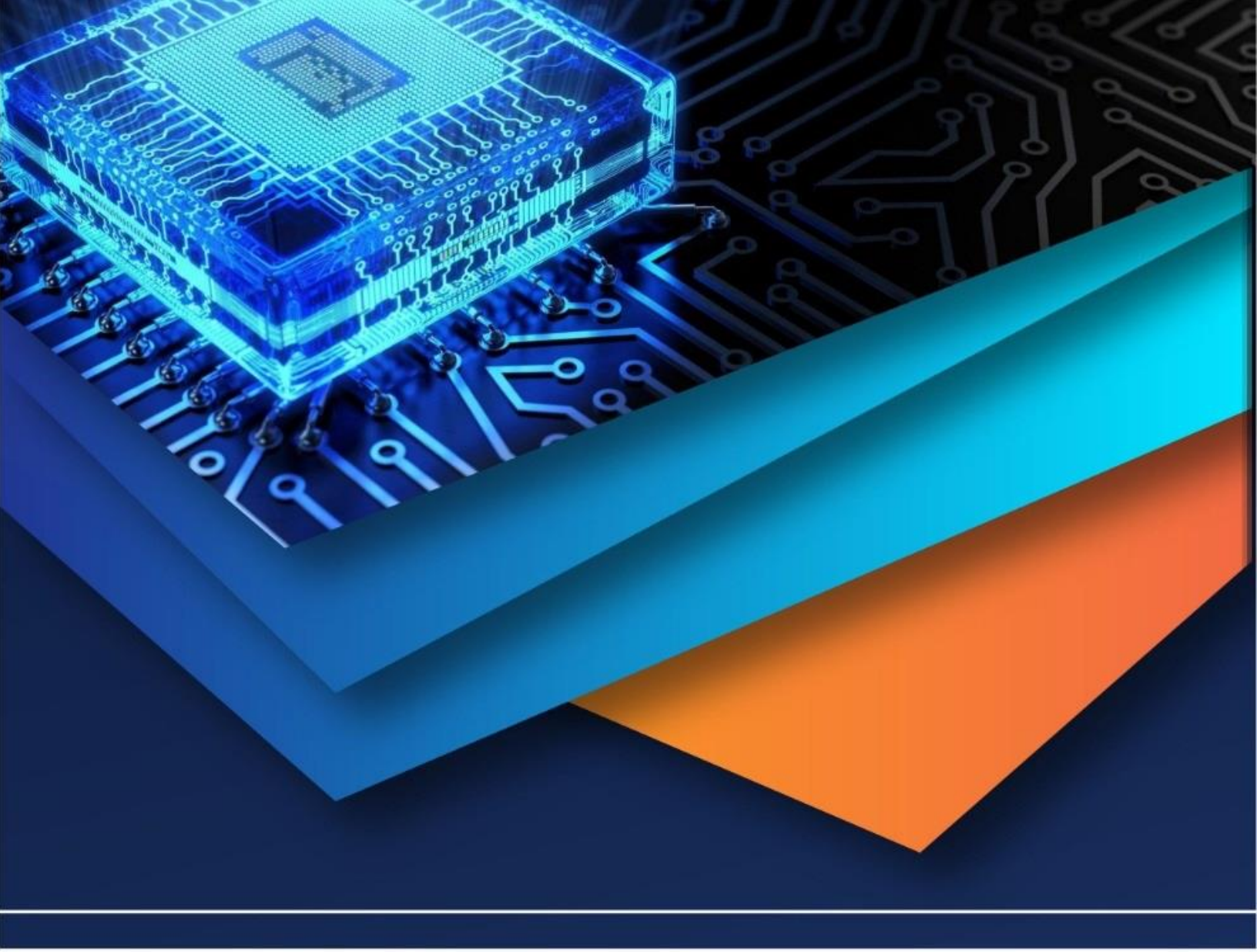
## VII. LIMITATIONS AND FUTURE SCOPE OF RESEARCH

In this work, the authors have taken data from the Web of Science database, so for better and more intensive analysis, other databases like Scopus, Lens, Pubmed, etc., can be integrate for a more holistic coverage of the research area. In the process of searches using only the 'sustainable finance' keyword, the authors have found a limited number of papers, so for a comprehensive study with 'sustainable finance' and some other included keywords, may give some new dimensions for the future researcher. This study has included only the "articles" category of documents, but in future research, inclusion of chapters in edited books and conference proceedings, could yield new research insights, for the area of Sustainable Finance.

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